

Bizarre XR

This article is a true description of an AECS technical help desk problem and how it was solved.

Vehicle

2003 Ford 5.4L 260kw Boss XR8.

Problem presented to the Helpdesk

The car was presented to the garage of this AECS customer with the following complaint:

The car has a light surge at cruise and under slight acceleration up gradients.

At the previous garages, the following tasks had been executed (and charged for): new plugs, brand new coils fitted, it has had the vacuum lines and PCV rubbers that always rub through replaced, all with no effect.

When it came to our workshop, we found that the long fuel trims had a variation of 15% between banks.

We went to do a Delta-N measurement with the ATS scope to track the issue down but the crankshaft tone wheel has 36 teeth so in our opinion not enough resolution to do a Delta-N on a V8. Please give your comments on the patterns attached.

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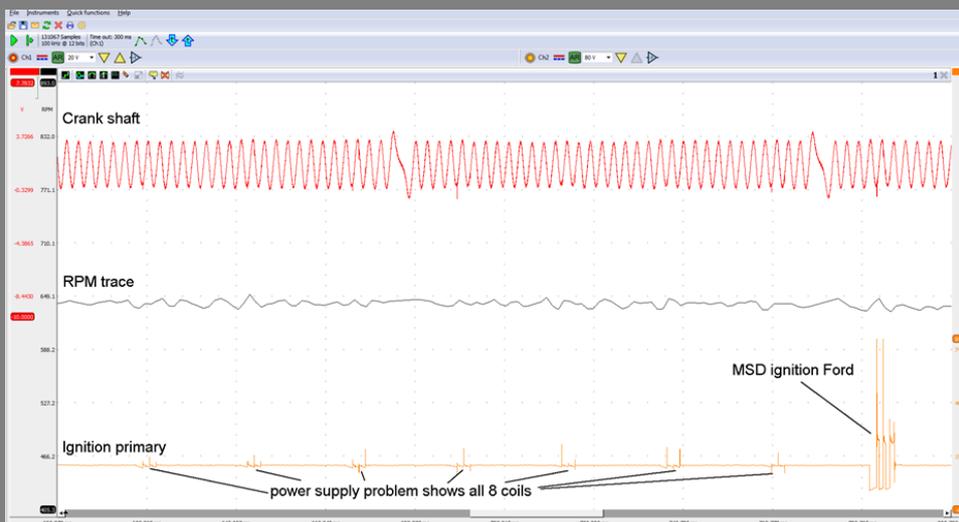
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Picture 1:
The ATS5000 2 channel scope recording shows crank shaft sensor vs Ignition primary, and a calculated RPM trace.

Technical support help desk.

The above RPM trace shows to us, despite lots of vertical zoom, indeed virtually no RPM fluctuations as a result of compression and ignition on the RPM trace. The scope owner incorrectly blames the spacing of the tone wheel teeth. At the end of this article, it will become clear why there is no Delta-N visible.... (Hindsight is easy).

Fuel trims

Because the Fuel trims are so different between the left and RH bank the technician has recorded the crank shaft vs oxygen sensor (picture 2), to see if any misfire became apparent.

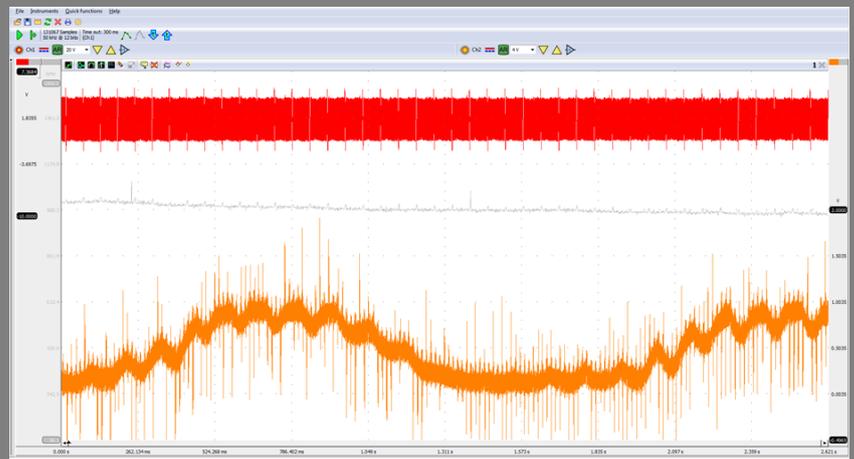
The recording of the oxygen sensor in picture 3 shows dips when it moves from lean to rich (from low to high). Zoomed in, it becomes clearer that only one bank is at fault.

During the cycling of the oxygen sensor, it is clear that every second revolution of the engine the mixture bias moves to leaner than intended. This explains why the fuel trim of one bank only was off. Could this mean that one bank had a lower fuel pressure...? No the injectors are all connected to the same fuel line. It had to be something wrong with the engine itself or the ignition system on one bank. The car has eight coils, all were tested with the scope and showed nothing wrong.

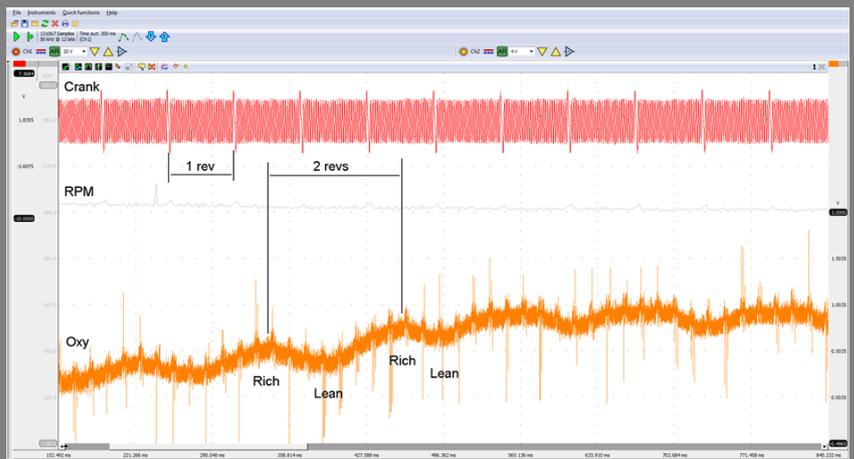
Mechanical

The next stage was to look at the engine and see if perhaps there was a mechanical issue. The easiest place to start is to do a compression test as in Picture 4. With the scope, a relative compression test can be performed in about 30 seconds or so.

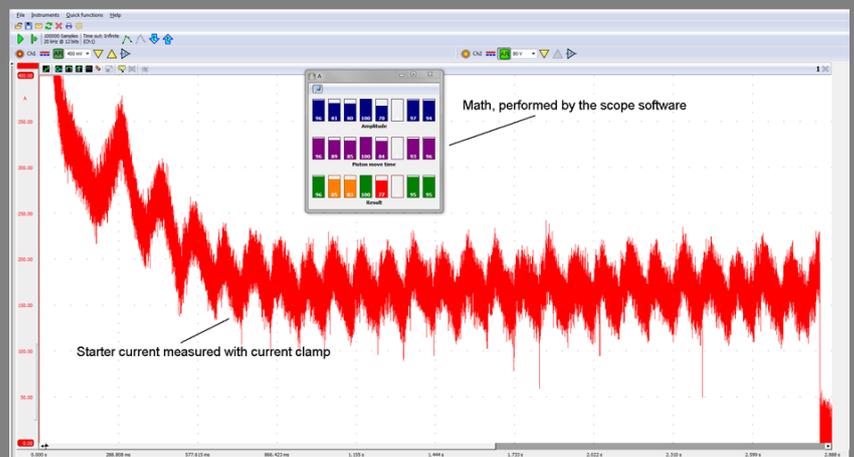
The relative compression test showed that definitely something was wrong with 4 cylinders. BTW, this test is *not* providing you with an



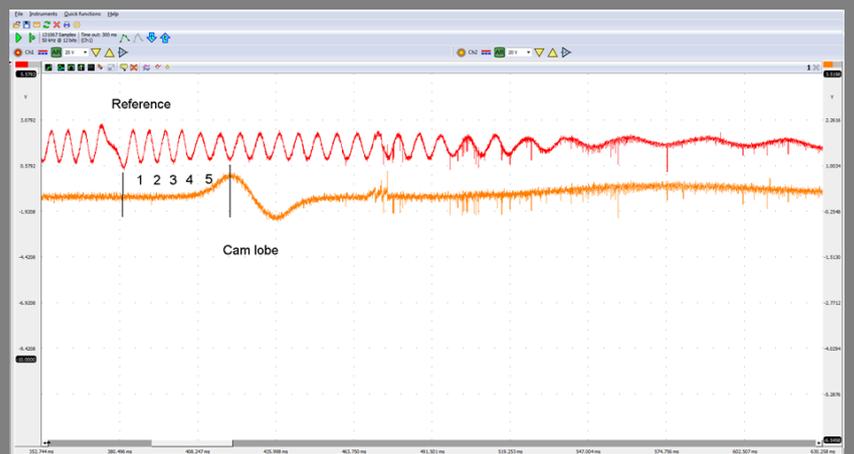
Picture 2: ATS recording of crank (plus RPM trace) and oxygen sensor.



Picture 3: Zoomed in on crank vs oxy.

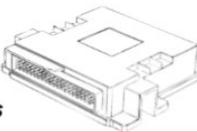


Picture 4: ATS scope relative compression test.



Picture 5: Winding over

[Click on pictures to get a clearer view](#)



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answer about "what is wrong" with which cylinder, it just shows that there is something wrong and that a pressure test needs to be performed.

The compression pressure tester showed the following (in old fashioned PSI...):

RHS bank (driver's side)

- 1-170
- 2-162
- 3-168
- 4-170

LHS (passenger's side)

- 5-149
- 6-150
- 7-151
- 8-155

The test clearly shows that there is an engine issue.

Timing

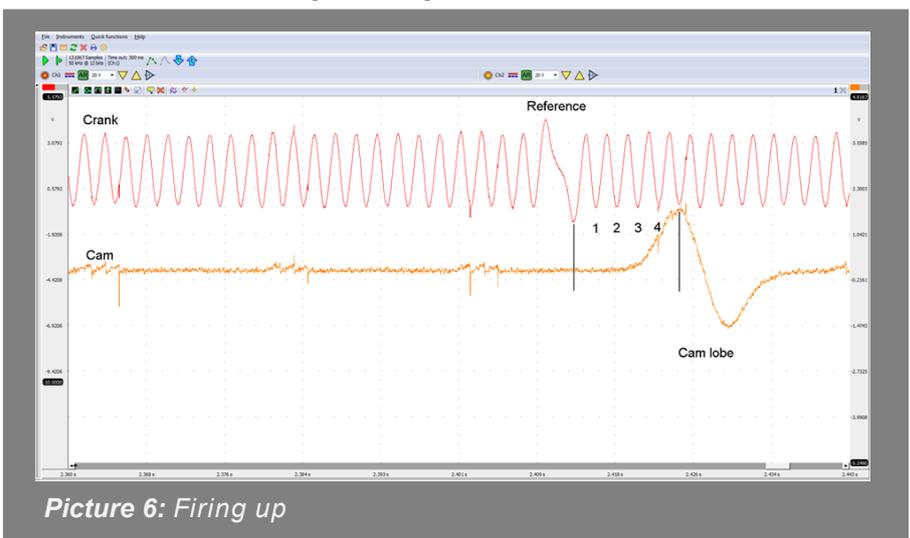
After discussing this on the phone, we came to the following conclusion:

The cam sensor is on the LHS bank only, they run a twin crank sprocket with 2 separate cam chains. If we had a cam chain issue like a broken guide on the LHS this would cause a phasing issue on that bank and could cause the compressions to ALL be down the same amount (which they are) on the one bank with similar symptoms on the LTFT's. This could also be the reason why sometimes it cranks with no start and kicks backwards if it does after long cranking

times say 5 sec or more. The technician checked the ignition timing with an old fashioned timing light and compared that to the value on his Launch scantool. The timing light showed 1 degree, while the scantool showed 10 degree advance.

Cam crank recording

Time to look at crank and cam signals! A recording was made during starting. In picture 5 & 6 we have zoomed in on two spots of the same



Picture 6: Firing up

recording.

Look at the scroll bar in the bottom of the pattern and see the time progression of the recording. Also, please look at the timing shift of the cam shaft in relation to the crank shaft (more than 10 crank degrees). This indicates to me immediately chain lash, or a loose tone wheel or something else mechanical. We deal with these issues in several AECS training seminars.

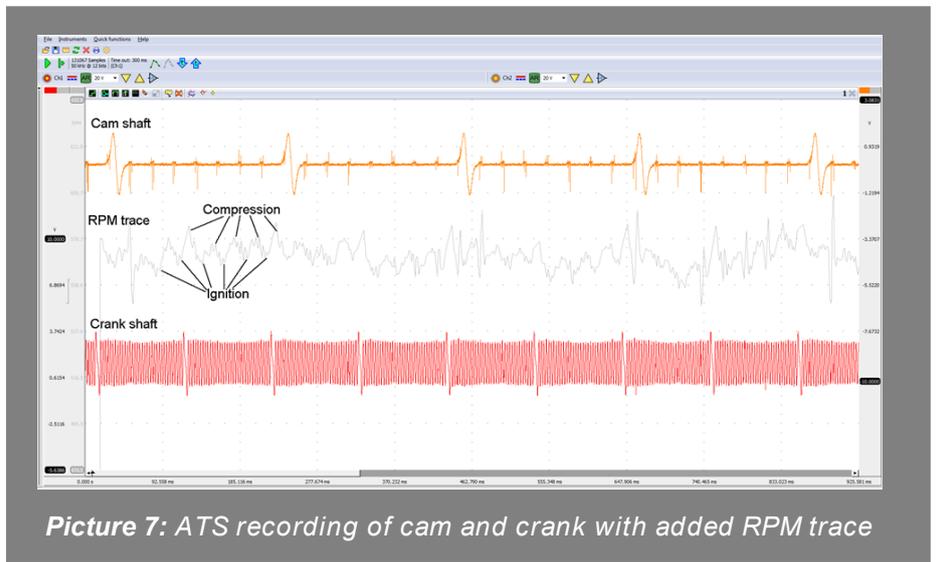
Finger tight

The technician pulled front of the engine. He found the crank pulley bolt was finger tight, the trigger wheel has been chattering on the crank keyway and now has about 1 1/2 teeth slop. This explains the scope patterns!

Fixed!

The technician replaced all front sprockets, chains, guide tensioners and recorded the following pattern as shown in Picture 7:

The cam and crank are continuous in perfect sync, also the crankshaft sensor signal shows "Delta-N" compression and ignition RPM changes) again!
Even Long Term Fuel Trims are equal between banks.



Picture 7: ATS recording of cam and crank with added RPM trace

Charge

Engine runs smooth and customer is happy. Time to charge for an efficient job done!

Conclusion

Not being able to see the Delta-N in one of the first recordings should have sounded the warning bells. With hindsight, we should have trusted the very accurate ATS scope better than we gave it credit for.

I wonder how long this job would have taken without the ATS scope, and without AECS backup. Clearly two other garages got unnecessary burned with this job

already. Make sure that you do not get into a position where you have to let go of highly profitable jobs and become dependent on other workshops in your area!

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12 Auckland AED	12	12 Dunedin - SCAN
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16	16	16 Nelson - EMS11
17	17	17
18 Auckland DMS 1-3	18 Good Friday	18
19 Auckland DMS 1-3	19	19
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